

Moving southeastward the depression was central north of Montreal, barometer 0.37 inch below the normal. At midnight of the 20th, threatening weather and rain prevailed in New England, the Lower Lake region and the St. Lawrence valley. At midnight of the 21st it was central south of Eastport; barometer 0.37 inch below the normal. Continuing to move eastward it was southeast of Nova Scotia on the afternoon of the 22nd. The track of the depression now recurved to the northeastward and it disappeared by midnight of the 23rd, until which time local rains continued in New England and the Maritime Provinces. Cautionary signals were ordered up at midnight of the 20th at Cape May, Delaware Breakwater and Chincoteague. They were lowered on the morning of the 21st, having been justified by maximum velocities of W. 31 miles at Cape May and Delaware Breakwater, and NE. 33 miles at Chincoteague. The latter-signal was ordered late.

No. V.—Appeared in Dakota on the afternoon of the 19th, Deadwood barometer 0.37 inch below the normal. The pressures were below the normal at this report in all districts in the United States, excepting the Northern and Middle Pacific coast regions. Moving southeastward the depression was central near Yankton on the afternoon of the 21st; Yankton barometer 0.53 inch below the normal. At this report the winds, in the Northwest and the Upper Lake region, were under its influence and local rains were reported from the Upper Lake region and the Upper Mississippi valley. During the night of the 20th and during the 21st, the depression moved eastward, causing numerous rains in the Northwest and the Upper Lake region, and at midnight of the 21st, was south of Chicago. On the morning of the 22nd, was south of Toledo, and at the afternoon report was west of Norfolk. Thence it moved southeastward; was south of Cape Hatteras on the morning of the 23rd; disappeared by the afternoon report. This depression caused heavy rains in the Ohio valley on the 21st and in the South Atlantic states during the night of the 22nd and morning of the 23rd. Cautionary signals were ordered at Toledo and Sandusky on the morning of the 21st, and lowered at the afternoon report of the 22nd, having been justified by a maximum velocity of E. 28 miles at Toledo. Signals were also ordered up from Kittyhawk to Chincoteague on the afternoon of the 22nd, and lowered on the afternoon of the 23rd. They were justified by the following maximum velocities: Kittyhawk, SW. 32 miles; Cape Henry, NW. 28, and Chincoteague, NE. 27.

INTERNATIONAL METEOROLOGY.

International charts, Nos. V and VI, accompany the present REVIEW. The former is published for the month of May, 1879, continuing the work for that year, which was delayed after the issue of chart No. V for the month of April, 1879, because of an intermission in the publication of the "Beobachtungen auf dem Nordatlantischen ocean" of the "Deutsche Seewarte." The series of this chart are now complete, from January 1877, up to, and including the present date. Chart No. VI is for August, 1879.

Chart No. V shows the mean pressure, temperature and the prevailing direction of the wind at 7.35 a. m. Washington, or 0.43 p. m. Greenwich, mean time, for the month of May, 1879, over the Northern and at certain isolated stations in the Southern Hemisphere. There are two small areas of low pressure, (29.80) for the present month, one situated just north of the Black Sea and the other covering Iceland, Greenland and the surrounding ocean north of parallel 60°. The former area occupies the precise region over which one of the low areas (29.80) of May, 1877, prevailed, while the latter presents a similar comparison with the position of the area of 29.80 in May, 1878. In addition it should be said, that a very small area, 29.60, (the lowest of the month), for May, 1878, lay off the northwest coast of Ireland. The pressure is generally above 29.90 throughout Asia, except in Toorkistan where probably another area of 29.80 exists; along the Asiatic coast the pressure is generally above 29.80, although the prevailing direction of the winds would seem to indicate the presence of such an area over the ocean south of the Kamtchatka peninsula. The pressure over Hindostan ranges from 29.51 at Patna and Deesa to 29.72 at Chittagong. In the United States the area of lowest pressure, 29.90, prevails over Texas and thence northward over the Eastern Rocky Mountain slope to Dakota. In Europe this area covers a small portion of southern France, northern Italy, Austria and southern Russia. The area of highest pressure (30.30), except at isolated stations, covers the Atlantic from 35° to 45° N., and 25° to 45° W. The area of 30.00 is common to the largest extent of territory, covering as it does the greater part of Europe, Algeria, the West Indies, Canada, Hudson's Bay Territory and in the United States, the Pacific coast and that portion of the country lying east of the Mississippi. The following are the highest readings from isolated stations: Angra and Ponta Delgado, 30.28 (769.0); Funchal, 30.15 (765.7); San Luis Potosi, 30.13 (765.2); Cape Town, 30.11 (764.7); Guadalajara, 30.10 (764.4); Mexico and Fao, 30.08 (763.9); Sfax, 30.06 (763.4); Mauritius, 30.04 (762.9). The extreme monthly range of mean pressure is 0.89 inch, which is 0.29 inch larger than in May, 1878, and more than double that for May, 1877. The lowest mean temperatures, given in Fahrenheit's scale, were reported from the following stations: Ft. St. Michaels, 26°; York Factory, 31°; Godthaab, 34°; Nikolaievsk on the Amoor, 35°; Stykkisholm and Tromso, 42°; Yeniseisk,

44°. The highest mean temperatures were reported from the following stations: Agra, 105°; Allahabad, 104°; Lucknow and Deesa, 103°; Lahore, 101°; Fao, 91°; Manilla, 86°; Free Town and Nukuss, 85°; Bridgetown, 84°. The prevailing direction of the winds was, over the United States, *northeasterly* in the Middle, South Atlantic and Eastern Gulf states; *southeasterly* between the 90th and 100th meridians; elsewhere *variable*. Over the Atlantic ocean south of parallel 40° N., *northeast* east of the 40th meridian and *southeast* to the westward; north of 40° N., *northwest* east of the 40th meridian and *southwest* to the westward. Over Europe the winds were generally from the *north* and *northwest*, shifting to *south* and *southwest* over Italy and Austria. Over Hindostan, *west* and *northwest*, except *south* along the southeastern coast. Along the Asiatic coast, *southeast* to *southwest* and *west*. Compared with *May*, 1877 and 1878, there is very little change in pressure along the Pacific coast of the United States and over that country between the 80th and 100th meridians. Over the Middle Atlantic states, New England and Canada, there has been a rise of 0.05 to 0.20 inch. The temperature west of the 100th meridian compares very closely with 1878, but is from 5° to 10° lower than 1877; eastward to the Atlantic, it is generally lower as compared with either year. Over the ocean comparison can only be instituted with 1878. Between the parallels of 30° and 60° N., there has been a very marked rise in pressure, varying from 0.20 to 0.48 inch, while from 20° to 30° N., there has been a slight fall. The temperature is generally high, except off the western coast of Europe, where the fall is quite sharp. Over Europe the pressure is from 0.05 to 0.20 inch above that for *May*, 1878, while as compared with *May*, 1877, it is lower over the northwestern portion by about 0.05 inch, and over the central and southern portions little or no change. Concerning the temperature, it is from 5° to 10° warmer over northern and eastern Europe than in 1877, but closely compares with 1878; over western Europe there is a decided fall as compared with either year, the decline extending southward into Algeria. Over British India there is a fall in pressure, as compared with either year, of from 0.05 to 0.20 inch, being most marked over the northern Provinces. The temperature, as compared with either year, is generally higher in the central and northern provinces; elsewhere lower. Compared with the mean of the past two years, the following deviations in temperature and barometer are reported from isolated stations: York Factory, +0°.1 and +0.03 inch; Ft. St. Michaels, -3°.8 and +0.23 inch; Godthaab, -2° and -0.14 inch; Stykkisholm, +2° and -0.15 inch; Tromsø, +0°.2 and -0.03 inch; Thorshavn, +0°.4 and +0.12 inch; Archangel, +3°.8 and +0.13 inch; Ekaterinburg, +15° and +0.10 inch; Barnaul, -8°.9 and -0.05 inch; Yeniseisk, -42°.9 and +0.07 inch; Nikolaievsk on the Amoor, -9°.7; Valdivostock, +0°.8 and -0.02 inch; Pekin, +2°.8 and -0.07 inch; Zi-Ka-Wei, +0°.5 and -0.03 inch; Tokei, +0°.7 and -0.02 inch; Tashkend, +3°.5 and -0.17 inch; Nukuss, +4°.7 and no change; Fao, compared with 1877 only, +12° and +0.05 inch; Beirut, -0°.5 and +0.02 inch; Mauritius, -2°.6 and -0.03 inch; Ft. Napier, -4° and +0.08 inch; Cape Town, +4° and +0.05 inch; Free Town, -1°.5 and -0.01 inch; Paramaribo, no change and -0.03 inch; Funchal, -0°.2 and -0.05 inch; Ponta Delgado, no change and +0.22 inch; Angra, +0°.1 and -0.26 inch; Bridgetown, +2°.6 and -0.10 inch; Navassa, -1°.6; Medellin, -0°.7; San José de Costa Rica, -3°.1; Mexico, -4° and -0.01 inch; Melbourne, -0°.5 and -0.07 inch; Hobart Town, -10° and +0.08 inch.

Chart No. VI.—This chart displays the tracings of the probable courses of 16 of the principal storm areas of the Northern Hemisphere for the month of August, 1879. The approximate paths of progressive movement are based upon daily simultaneous international observations to the number of over 650, besides a large mass of irregular data which reaches this office in various ways, from the logs of vessels of the Merchant Marine of the North Atlantic ocean. Unusual interest attaches to the low areas of this month, owing to the peculiar course of No. I, but more particularly to the evidences of cyclonic disturbance, as indicated in the characteristic courses of Nos. X and XIII. Concerning the general distribution of storm paths, the following is given: Six storms were confined to the territory of the United States and Canada and the neighboring waters, as included within the meridians of 60° and 100° W. and the parallels of 15° and 50° N. Two originated over the United States, but passed over the ocean to near the main-land of Europe. Two first appeared over the ocean between Greenland and northwestern Europe, passing thence northeastward and disappearing north of Russia. Three formed over the ocean southwest of the British Isles, two of which, after crossing them, passed eastward over central Europe, while the other passed northeastward north of Scotland, and after crossing northern Scandinavia, disappeared over northern Russia. Two formed over southern Russia, taking thereafter an easterly course, and one passed northeastward from the Japan sea to the Aleutian Islands. Of the storms over North America, No. I appeared in Manitoba on the 1st, the area of low pressure extending southward into Kansas, with southerly winds thence northward; Ft. Garry, 29.76, SE.; Pembina, 29.70, S. During the 2d and 3d, passed eastward over the Provinces of Ontario and Quebec attended by light rains and moderate changes in pressure. Morning of the 4th, central over the Gulf of St. Lawrence, with light to brisk winds and occasional rains. 5th, remained about stationary, with slowly rising pressure, developing on the 6th into a very marked depression, the barometer having fallen in the past 24 hours from 0.15 to 0.25 inch. 7th, central off the southwestern coast of Newfoundland; Sydney, C. B., 29.31, SW.; Charlottetown, P. E. I., 29.48, NNW; St. John's, Nfld., 29.74, SE. 8th, central over the ocean to the southeast of Newfoundland; in

45° 30' N., 50° 40' W., 29.61; at St. John's the barometer rose to 30.12, wind SW. 9th, passed northeastward to near 50° N., 35° W.; in 47° 35' N., 33° 30' W., 29.57, NW. fair; in 49° N., 30° W., 29.48, SW. fair; in 44° 34' N., 52° 21' W. S. S. *Westphalia* encountered violent NNW. storm, high seas; in 48° N., 24° W., 29.74 S., force 7, light rain. 10th, in 49° 30' N., 28° 35' W., 29.43, N. fair; in 48° 45' N., 27° 35' W., 29.50, S. fair; in 51° N., 35° W., 29.74, NW., force 8, thunder-storm; in 52° N., 31° W., 29.71, NNW., force 7, drizzling; in 46° N., 27° W., 29.51, W., force 3, light rain; in 47° 35' N., 35° 40' W., northerly gales, heavy squalls. 11th, central in about 48° N. 18° W.; during the presence of the low area off the western coast of Europe, southeast to southwest winds were superinduced, and occasional light rains prevailed over the British Isles. The southeastward progress of the depression in this latitude was checked on the 11th, and its course turned to the northwestward, probably as the result of the presence of two areas of high pressure, one over central Europe and the other situated to the south of parallel 40° N. During the day, as the storm pursued its peculiar course to the west of the British Isles, extremely violent gales and heavy seas were experienced, several vessels wrecked and many badly damaged; bark *St. Andrew*, from New York for Dunkirk, reported violent hurricane, lost sails and cargo; *S. S. Ibranos*, from Liverpool for New York, reported hurricane from SE. to SW., lasting 10 hours, lost sails, stove bulwarks; *S. S. Reviver* reported most violent hurricane from SE., shifting to E. and N., with thunder and lightning and torrents of rain, confused sea from all points, lasting 8 hours, barometer fell 0.40 inch in 25 minutes. 12th, central in about 60° N., 30° W.; in 51° 40' N., 28° 50' W., heavy westerly gale, high head sea; southerly winds prevailed over the British Isles, with occasional light rains, the pressure slowly rising at southerly stations and falling over Scotland and to the northward; at Stykkisholm, barometer 29.37, SE. rain; in 55° 45' N., 50° W., 29.66, SE. rain; at Gothaab, 29.74, SW. fair. 13th, central north of parallel 60° N. and between the meridians of 30° and 40° W.; Stykkisholm, 29.33, SE. rain; Gothaab, 29.58, W. W. fair; in 54° N., 50° W., WNW., violent hurricane, heavy rain; over the British Isles, the pressure fell generally from 0.05 to 0.15 inch, with SE. to W. winds and occasional light rains. 14th, central north of Iceland, the depression spreading westward over Greenland and Baffin's Bay; Stykkisholm, 29.43, S. rain; Gothaab, 29.39, SSW. foggy; the pressure rose rapidly over the British Isles, winds shifting to westerly with clearing weather. On the 15th the winds at Gothaab and Stykkisholm still remained southerly, with rain at the latter, but rapidly rising pressure at both stations. 16th, conditions changed by the presence of low area No. VII to the southward. No. VII.—During the 10th the pressure fell quite rapidly in the Northwest and Manitoba, and by the morning of the 11th the depression was central in Minnesota; St. Paul 29.75, SE. During the 12th and 13th passed eastward over the Upper Lakes and Canada, and on the morning of the 14th was central north of Quebec; barometer 29.53, NW., rain; Farther Point, 29.84, SW., fair. 15th, probably central over Labrador, thence pursuing an easterly course over the ocean to the south of Greenland. 16th, barometer at Gothaab 29.48, a fall of 0.23 inch in past 24 hours, wind changed from S. to N.; Stykkisholm, 29.85, a fall of 0.15 in past 24 hours, atmosphere calm, wind previously from the south; in 51° 35' N., 50° W., 29.57, W., violent gale, heavy rain; in 52° 25' N., 31° W., 29.97, SE., cloudy. 17th, central in about 58° N., 40° W.; barometer below 29.60 from Labrador to the meridian of 20° W.; Gothaab, 29.47, S.; Stykkisholm, 29.82, calm; in 54° N., 22° W., 29.49, SE., heavy rain; in 50° 45' N., 48° W., 29.56, WNW., violent gale and rain. 18th, central in about 58° N., 30° W.; Gothaab, 29.74, calm; Stykkisholm, 29.66, SE., brisk, fair; in 55° 35' N., 14° 40' W., 29.51, SW., heavy rain; in 53° N., 34° W., 29.27, SSW. rain; at interior stations, British Isles, the pressure rose considerably, but fell along the western coast, with winds shifting to east and northeast. 19th, central in about 55° N., 20° W.; in 52° N., 36° W., 29.41, NW., rain; in 50° N., 23° 40' W., 29.39, W., gale, fair; in 48° N., 34° 35' W., W., gale, heavy rain; the winds at Thorshavn and Stykkisholm changed from southeast, to northeast and northwest respectively, with rising pressure: over the British Isles the winds changed from northeast and east to southeast and southwest, with a variation in pressure of from +0.05 to +0.12 inch. 20th, central off the Irish coast; in 50° N., 28° W., 29.35, W., rain; in 49° N., 27° W., 29.35, SW., heavy rain; over the British Isles, cloudy, gloomy or rainy weather with southwesterly winds prevailed, the pressure had fallen at all stations, but particularly along the western coast, where a change of from -0.15 to -0.27 inch was reported. During this day the course of the depression was changed to the north-northeast just as the conditions appeared to be favorable for its crossing the British Isles. This peculiar disposition of pressure in the progressive movement of the central area, viz: to skirt the coast of western Europe, characterized the low area throughout the remainder of its course, which bounded Scandinavia to the west and north. It is of importance to note in connection herewith, that on the 20th an area of high pressure (over 30.00) formed over central Europe, and moved in a parallel course with the low area, to the northeastward. On the 23d this high pressure covered central Russia with an area of over 30.10. 21st, depression central off the west coast of Scotland; in 51° N., 18° W., 29.27, SW., cloudy; Thorshavn, 29.43, NE., fair; Galway, 29.42, S., cloudy; Valencia, 29.43, SSE., misty. 22d, central north of Scotland; pressure fell very rapidly at all northern stations in the British Isles, but rose slowly to the southward with winds shifting from south to southwest and west; lowest pressures as follows: Thorshavn, 29.20, W.; North Unst, 29.22, SW.; Nairn, 29.26, SW.; Sandwick Manse, 29.27, SW.; Ardrossan, 29.33,

SSW. 25d, during the day, and with much diminished pressure, the depression passed northeastward along the western coast of Norway, and on the morning of the 24th was central north of Tromsø, barometer 29.24, wind SW: southwesterly winds with falling barometer prevailed over Scandinavia. 25th, central north of the White Sea, the area of 29.40 extending eastward from northern Norway to the meridian of 90° E., and southward to parallel 60° N.; Tromsø, 29.25, SW.; Archangel, 29.47, WNW.; Yeniseisk, 29.45, SE.; Barnaul, 29.44, SW. 26th, pressure rose rapidly at all stations above named, but direction of wind remained the same except at Barnaul which changed to northwest. No. IV.—Since the 4th the pressure had been generally below the normal over the United States between the 80th and 100th meridians, with no well defined area of depression. During the 6th a decided fall in barometer took place over Lake Superior and to the northward, followed by brisk southerly winds over Upper Lake region, Tennessee and the Ohio valley. On the morning of the 7th depression was apparently central over Lake Huron; Alpena barometer 0.23 inch below the normal. 8th, central near Quebec with a barometric trough below 29.80 extending southward to Virginia. During this day and the following the depression passed northeastward beyond the Gulf of St. Lawrence, disappearing in a high pressure area then prevailing over the ocean to the south of Greenland. No. VI.—This area developed on the 8th off the North Carolina coast. Only slight evidence of its existence was shown from stations along the South Atlantic coast, the pressure having fallen about 0.04 inch in the past 24 hours. The winds were southwest and west, accompanied by occasional light rains. In the vicinity of 34° N., 70° W., the winds were southeast to southwest, brisk, with rainy or threatening weather; barometer about 29.75. On this date the centres of two other depressions (Nos. I and IV) were located to the north and northwest, one in the lower St. Lawrence valley and the other in about 45° N., 48° W. This disposition of pressure gave existence to a most irregular and peculiar shaped area of low, (29.80) running from near the northwestern coast of Ireland southwestward to latitude 49° N. and thence west-southwest within much narrower limits to the New Jersey and Massachusetts coasts, from which locality it extended northward between the meridians of 70° and 80° W. over Canada and Hudson's Bay. This irregular elongated area of depression was bounded to the north and south by areas of high pressure, over Newfoundland above 30.10, and over the Azores above 30.20. 9th, area central, with more decided form, in about 38° N., 70° W.; in 37° N., 62° W., 29.95, violent SW. gale, heavy rain; in 42° N., 60° W., 29.86, SSE., brisk, heavy rain; in 38° N., 72° W., 29.90, N., brisk, fair; off Cape Hatteras, violent SW. and W. squalls with high seas; along the Atlantic coast from Wilmington to Boston west to northwest winds prevailed with pressures generally below 29.90. 10th, central south of Nova Scotia, but depression extended south westward below parallel 40° N.; in 39° N., 67° W., 29.82, SW., brisk, fair; along the Middle Atlantic and New England coasts winds shifted to northerly (brisk to high) with rising pressure; off Cape Hatteras bark *Grace Bradley* experienced terrific gale from the north lasting 6 hours, and finally settling into a heavy northeast gale with tremendous high sea, decks swept of everything. 11th, rain with north to west winds and rising pressure (generally above 30.00) prevailed over the ocean southeast of Nova Scotia; in 41°, 56' N., 61°, 06' W., ship *Prince Louis* experienced short hurricane or whirlwind, commenced at east-southeast and shifted suddenly to southwest and then northward, lasting three hours; lost sails and mast, leaving the ship helpless; two seamen washed overboard; in 41°, 20' N., 64° W., ship *Ant Inette* reported violent southeast to northeast gale; vessel foundered at 6.30 p. m. Rain or threatening weather with brisk to high southwest to northwest winds prevailed over the ocean south of Newfoundland on the 14th, during which time several vessels experienced very rough handling and much damage to mast and sail. No. X.—Considerable interest attaches to the development and progress of this depression because of its cyclonic action, the unusually large number of vessels wrecked and the remarkable narrowness of the area of atmospheric disturbance. On the 14th the area appeared to be central over the Caribbean sea, south of Porto Rico; in fact from the disposition of surrounding pressure it appears highly probable that the area originated within this natural amphitheatre formed by the western Antilles to the north, the Lesser Antilles to the east, and the Leeward Islands to the south. Over the ocean north of parallel 20°, an area of high pressure from 30.00 to 30.20 prevailed, and south of parallel 10° an area of 30.00 to 30.10. At Bridgetown, Barbadoes, barometer 29.94, a rise of 0.05 inch in past 24 hours, wind shifted from NE. to E; Fort de France, Martinique, 29.81, no change in past 48 hours, barometer morning of the 11th, 29.83; San Juan de Porto Rico, 29.95, a fall of 0.07 inch in past 24 hours, wind shifted from SE. to E; in 18° N., 64° W., 29.56, a fall of 0.08 inch in past 24 hours, wind shifted from E. to NE. Stations in advance of the immediate centre of depression reported as follows: Navassa, 29.93 or —0.05 inch in past 24 hours, wind steady from the east since the 1st; Kingston, Jamaica, 30.13 or —0.06 inch in past 24 hours, winds shifted from N. to NW. 15th, probably central south of St. Domingo; San Juan de Porto Rico, 30.01, SE., rain; Ft. de France, 29.87; Bridgetown, 29.96, NE. with increasing force; Santiago de Cuba, 29.97, N., light; Navassa, 29.93, NE.; Kingston, 30.14, NE. 16th, central south of Santiago de Cuba, barometer 29.96, occasional heavy showers fell during the day with squalls from the southeast, at midnight barometer rose to 29.99, atmosphere calm; in 19° 45' N., 75° 50' W., S. S. *Pomona* experienced hurricane from NE. to SSW., blowing with great violence, accompanied by heavy cross-seas lasting thirteen hours, after which moderated to a gale with heavy rain squalls; Na-

vassa, 29.90, E.; Kingston, 30.11, SE.; Nassau, Bahamas, 29.87, or -0.12 inch in past twenty-four hours, wind shifted from SE. to N.; Grand Turk, Bahamas, 29.90, or $+0.15$ inch in past twenty-four hours, winds shifted from NE. to SE.; twenty miles east of Watling's Island, Bahamas, brig *Dashaway* had severe hurricane from NE. to SE. and S., lasting ten hours. 17th, central north of Nassau, barometer 29.86, S., heavy rain: Grand Turk, 29.90, SE., strong; Santiago de Cuba, 29.92, NE., fair; Nava-sa, 29.90, NE., cloudy; Havana, 29.88, or -0.05 inch in past twenty-four hours, atmosphere calm, wind previous day from the SE.; at all Florida stations the winds shifted from SE. and E. to N. and NW., with falling barometer. At this point it is of interest to call attention to the comparatively slight changes in pressure at all stations heretofore named, indicating their position as on the outskirts of the depression which was previously referred to respecting its narrow diameter. During the 17th the depression passed northward in a course curving slightly to the east, path about two hundred miles off the Florida and South Atlantic coasts. 17th, in $31^{\circ} 45' N.$, $79^{\circ} W.$, schooner *C. Berry*, about 11 p. m., struck terrific hurricane from NNE., accompanied with tremendous sea and rain; in $41^{\circ} N.$, $68^{\circ} W.$, S. S. *Metcalf*, violent hurricane from SE., veering suddenly to NE., lasting three hours; in $31^{\circ} N.$, $78^{\circ} 30' W.$, 10 p. m., schooner *Drummond* struck cyclone accompanied by heavy cross-seas, vessel on beam-ends for two hours; in $29^{\circ} N.$, $78^{\circ} 30' W.$, hurricane from SSE., decks swept. 18th, 6.30 a. m., central on the North Carolina coast, Cape Lookout 29.15 or 0.84 inch below the normal, wind SE., 138 miles per hour; at other coast stations the wind velocities ranged from 68 to 100 miles per hour. In $32^{\circ} N.$, $72^{\circ} W.$, hurricane from SSE. to WNW, lasting twelve hours and blowing fearfully in squalls. About 200 miles north of Chincoteague, S. S. *Johns Hopkins*, reported the following observations: 12.0 p. m., 29.95, SSE.; 1 p. m., 29.80, SE. and S., brisk; 1.30 p. m., 29.65, ESE., gale; 2 p. m., 29.05, E., gale; 2.30 p. m., 28.90, calm for twenty minutes; 2.45 p. m., barometer rising, wind XNW, with great fury; 5 p. m., moderate weather. S. S. *Lord Clive*, in about $39^{\circ} N.$, $73^{\circ} W.$, 8 a. m., 30.02, rain; 10 a. m., 29.90, ENE., light; noon, 29.80, strong breeze, heavy rain, rising sea; 2 p. m., 29.60, NE., tremendous high sea; 3 p. m., slowed engines and put ships head to the eastward; 4 p. m., 29.44, NNE., hurricane, blinding rain, high confused sea; 5 p. m., 29.60, wind suddenly flew into the NW. with fearful violence and high cross-seas; 6 p. m., ditto; 8 p. m., gale moderating, clear to the NW., sea going down, ships head put to the westward; 9.30 p. m., Absecon Light abeam, sea moderating; midnight, 29.90, moderate west breeze. About 15 miles NE. of Cape Henlopen, schooner *Sea Bird*, 5.30 p. m., struck hurricane and was carried 50 miles south. Ten miles south of Vineyard, schooner *Skylark* encountered heavy gale from E., veering around to NW., in which vessel scud under bare poles for thirteen hours. Off Chincoteague, S. S. *Lucretia*, NE. veering to NW. violent gale, heavy rains and high seas. About 30 miles SE. of Five-fathom Bank Lightship, bark *E. J. McManerry*, from Havana to New York, August 20th, experienced fine weather to the 18th, when barometer began to fall rapidly, wind SE., rain in torrents; 2 p. m., wind ceased at SE. leaving a terrific sea, suddenly wind came from NNW., carrying away portion of masts and sails; for two hours vessel in a perfect cyclone and literally submerged. Twenty miles east of Sandy Hook, violent hurricane from ENE. to NW., lasting eight hours. Off Nantucket, violent SE. gale, lasting ten hours. Forty miles east of Cape Cod, heavy NE. gale, lasting eight hours. Thirty miles off Sandy Hook, S. S. *Reindeer*, heavy NE. gale, lasting eight hours, lost masts and bulwarks, decks completely under water for five hours. 19th, 7.35 a. m., central south of Eastport, barometer 29.30, or 0.70 inch below the normal, lowest, 29.16 at 11.15 a. m., wind NE., 34 miles; the winds along the New England coast veered from E. to S. and NW., with velocities ranging from 25 to 60 miles per hour. In $38^{\circ} 29' N.$, $74^{\circ} 16' W.$, S. S. *Holbrook* encountered the end of a hurricane, wind blowing from NW. to NE., changing suddenly, sea terrific, decks swept. Thirty miles S. of Gay Head, near Vineyard Haven, 6 p. m., hurricane, carrying away sails and small boats; lay to for about two hours with lee-rail under water and sea washing deck. In $42^{\circ} 50' N.$, $67^{\circ} 45' W.$, schooner *J. W. Nickerson*, terrific cyclone for sixteen hours. In $42^{\circ} 38' N.$, $65^{\circ} 20' W.$, S. S. *Memento*, revolving gale from SW. to NW. with heavy cross-seas, lasting twelve hours. In $41^{\circ} N.$, $65^{\circ} 56' W.$, violent SW. gale and high seas for twenty hours. Sixty miles S. of Cape Sable, fearful SE. gale, decks swept. In $34^{\circ} N.$, $73^{\circ} 30' W.$, terrific gale from ESE. to NW. In $42^{\circ} N.$, $63^{\circ} W.$, violent SW. to W. and NW. gale and high seas. In $42^{\circ} N.$, $79^{\circ} W.$, violent SE. to SW. and W. gale, tremendous high sea. 20th, 7.35 a. m., central south of Newfoundland, depression slowly filling up. From Maine eastward to Cape Breton Island the winds were NW. and N., pressure ranging from 29.54 to 29.90, lowest at Sydney, C. B.; over Newfoundland and southeastward to $50^{\circ} W.$, winds, SE., barometer 29.76 to 29.94. 21st, passed eastward beyond $50^{\circ} W.$, combining with an area of 29.80, then prevailing over the ocean in the region of parallel $50^{\circ} N.$ and forming a part of low area No. VII, then central off the Irish coast. No. XII.—With the pressure below the normal over the Southeast Rocky Mountain slope and Texas since the 13th, the area appeared central in Indian Territory on the morning of the 15th; thence its course was northeastward over Tennessee and the Ohio valley to central New York, where on the morning of the 17th it appeared to be about stationary, with NE. to SE. and S. winds and rain along the Middle Atlantic coast. On the 18th, these winds had changed to N. and NW., with a slight rise in pressure, rain continuing, but more general and heavy, owing to the

advance of low area No. X, then on the North Carolina coast. No. XIV.—On the 20th, from the Saskatchewan valley southward to New Mexico, an area of low pressure, generally below 29.80, prevailed. By the 21st this area had taken more decided form and was central in Minnesota, lowest barometer at Breckinridge, 29.54. 22d, central over Lake Michigan, Escanaba 29.52, or 0.42 inch below the normal. During the 23d and 24th depression remained about stationary in the Lower St. Lawrence valley, accompanied by light rains and east to south winds, fresh to brisk. 25th, depression passed southeastward off the Nova Scotia coast, followed over the Maritime Provinces by NE. to NW. winds and rising pressure. No. XIII.—This storm, like No. X, possesses throughout portions of its course the characteristics of a tropical cyclone, but lacks decidedly in the extraordinary power manifested by the latter. On the 20th, the pressure fell over the southern portion of the Gulf of Mexico as indicated by the barometer readings at Havana and Tlacotalpam, the former 29.87, and the latter 29.85, a fall at both stations of 0.02 inch in past twenty-four hours. Fifty miles east of Alacran Reef, off the northern coast of Yucatan peninsula, bark *Elrina* encountered violent cyclone from ENE., which ended on the following day at 4 p. m., with wind SSE.; very high seas and terrific squalls were experienced as the vessel passed to the westward; considerable damage was reported from the vicinity of Progreso on the northwestern coast of Yucatan, and also along the Bay of Campeachy. 21st, pressure fell considerably at all Gulf stations, and high NE. to NW. winds were anticipated along the northern coast. At Tlacotalpam barometer 29.79, a fall of 0.06 inch in past twenty-four hours, wind shifted from N. to W. with heavy rain, 2.37 inches in past twenty-four hours. 22d, central south of Galveston, the pressure falling rapidly along the northern Gulf coast, giving a variation of from -0.15 to -0.24 inch in past twenty-four hours; the rainfalls were unusually heavy and the winds mostly from the north, increased to high. 23d, central in eastern Texas, where the pressure was generally below 29.50, lowest barometer at Shreveport, 29.31; very heavy rainfalls, but no dangerous winds, so far as reported, accompanied the progress of the area on this day. During the 24th and 25th, the depression passed northeastward over Tennessee and the Ohio valley, accompanied by quite decided changes in pressure, northeast to northwest winds and occasionally heavy rains. On the morning of the 26th central on the North Carolina coast, where brisk to high NW. to SW. winds were reported, pressure generally below 29.80. During this day and the following passed eastward to near the 70th meridian and thence northeastward to parallel 40° N. 28th, in 38° N., 71° W., 29.92, NE., high, fair; in $40^{\circ} 30'$ N., $67^{\circ} 40'$ W., 29.90, E., high, heavy rain; in 43° N., $64^{\circ} 45'$ W., 29.95, NE., brisk, fair. 29th, central south of Nova Scotia, with SE. to N. winds and rain over the Maritime Provinces. In $42^{\circ} 30'$ N., $63^{\circ} 45'$ W., 29.65, NE., rain; in $40^{\circ} 35'$ N., $66^{\circ} 25'$ W., 29.92, NNW., fair; in 41° N., 62° W., 29.75, SW. gale, thunder-storm; in 43° N., 60° W., 29.76, SSW., brisk, rain and lightning; in 40° N., 69° W., 30.10, NW. gale. During the 30th and 31st, passed northeastward south of Newfoundland, combining with an area of 29.80, then prevailing over the ocean in the vicinity of parallel 50° N. Of the storms confined to the ocean northwest of the British Isles, No. II appeared on the 1st in about 60° N., 10° W.; Thorshavn, 29.66, NE.; Stykkisholm, 29.93, NW.; Sandwick Mause, 29.54, W. 2d, central north of Scotland; Thorshavn, 29.47, N.; Sandwick Mause, 29.95, WSW.; pressure rose rapidly over northern Scotland, with winds shifting to SW. During the passage of this storm northeastward, the pressure remained generally above 30.00 over the central and southern portions of the British Isles, with clear or partly cloudy weather and W. to NW. winds. During the 2d, depression passed rapidly northeastward along the western coast of Norway, affecting the pressure very slightly at coast stations, and on the morning of the 3d appeared to be central north of Scandinavia; Tromso, 29.94, a fall of 0.10 inch in past 24 hours, wind S., rainfall 0.76 inches in past twenty-four hours; during the day area disappeared to the eastward. No. XVI.—After the passage eastward over northern Scandinavia of area No. XV, the pressure during the 29th again fell to the westward in the vicinity of Iceland, barometer at Stykkisholm, 30th, 29.57, a fall of 0.13 inch in the past twenty-four hours. On the morning of the 30th, area probably central southwest of Iceland; Godthaab, 29.80, S., rain. 31st, depression probably passed northeastward between Greenland and Iceland; Stykkisholm, 29.29, S., about 40 miles per hour; Godthaab, 29.72, N., about 40 miles per hour. During the day area disappeared over the Arctic Ocean. Of the storms over Europe No. III appeared off the northwestern coast of France on the 5th; pressure generally below 29.80 northeastward to northern Norway, with occasional light rains: 6th, central over southern Scotland; Silloth Rectory, 29.47, NW., cloudy; Glasgow, 29.48, WNW., threatening; Ardrossan, 29.49, NW., cloudy; Aberdeen, 29.52, ENE., cloudy; Nairn, 29.54, NE. rain. The variation in pressure at British stations in the past twenty-four hours ranged from 0.15 to 0.27 inch. 7th, central over the North Sea, near parallel 60° N.; diameter of depression very narrow; changes in pressure in past 24 hours were reported as follows: Brono, -0.20 inch; Christiania, -0.09 ; Bergen, -0.08 ; Aberdeen, $+0.03$; Nairn, $+0.05$; Vestervig, $+0.07$; Ardrossan, $+0.18$. 8th, central over southern Sweden; Wisby, 29.50, NNW.; Upsala, 26.60, ESE.; Christiania, 29.65, NNW., rain; over Denmark and the southern shores of the Baltic the pressure was generally 29.80 and below, with SW. to NW. winds; southeast of the Baltic, in Russia, the winds were SE. to SW., with occasional light rains. 9th, depression about stationary, with slowly falling barometer; Upsala, 29.39, E., rain; Stockholm, 29.41, WSW., rain; Christiania, 29.51, NW., cloudy; pressure falling slowly over eastern Russia,

with occasional light rains and SE. to SW. winds. 10th, central near the Gulf of Riga; Wisby, 29.55, NNW., about 40 miles per hour, rain; Upsala, 29.59, ENE., rain; Stockholm, 29.56, E., rain; Memel, 29.48, west, violent gale, about 70 miles per hour, accompanied by rain; Königsberg, 29.34, W., violent gale, about 60 miles per hour, with rain; over Denmark, Prussia and along the southern coast of the Baltic, high N. and NW. winds, with occasional heavy rains, prevailed throughout most of the day; in eastern Russia barometer still falling, with rain and S. to SE. winds. 11th, central over eastern Russia, near Wilna; barometer, 29.38, a fall of 0.21 inch in past 24 hours; over Denmark and Prussia the winds still remained westerly, but with greatly diminished force, while along the southern coast of the Baltic they had changed to north, with heavy gales; pressure fallen throughout Russia. 12th, central near Moscow; barometer, 29.19, a fall of 0.49 inch in past 24 hours. During this day and up to the 18th the depression remained over central and western Russia, with a sluggish movement to the eastward. On the 13th the pressure rose abruptly to about 29.60, which condition was maintained with considerable variability until the depression crossed the western border of Siberia on the 18th, when it rose on the following day at Ekaterinburg from 29.55 to 29.76. 19th, central in the valley of Obi near 60° N., 80° W.; Barnaul, 29.39, SW.; Yeniseisk, 29.31, E., a fall of 0.59 inch at the former, and of 0.27 inch at the latter station in the past 24 hours. 20th, probably central over the Province of Irkutsk; Yeniseisk, 29.47, W. rain; Barnaul, 29.65, W. fair. The further course of this area could not be traced, owing to lack of reports from eastern Siberia, although it is believed that the depression reached the Asiatic coast, probably in the vicinity of Nikolaievsk on the Amoor; the barometer fell steadily at coast stations from the 19th to the 22d. No. XI.—This area was probably a secondary development from area No. I during the existence of the latter over Iceland on the 14th, as on that day an area of 29.80 extended southward to the 55th parallel west of the 10th meridian, and on the 15th reached the northwest coast of Ireland. Galway, 29.78, SE. rain; Armagh, 29.88, ESE.; over Scotland, northward to Thorshavn, the winds were from the E., and pressure generally above 29.90. 16th, pressure fell below 29.80 at all British stations except Valencia, the area extending southeastward into Austria, with occasional rains and variable winds; no well defined centre of depression. 17th, area developed more decidedly, and was probably central over the southern portion of the North Sea, followed by NE. to NW. and SW. winds over the British Isles; Bolton, 29.42, NE.; Bidston, 29.45, WNW. rain; Leicester, 29.45, W. rain; Silloth Rectory, 29.45, W.; along the eastern and southeastern coasts of the North Sea the winds were S. and SE., with the barometer generally below 29.70. During the 18th and 19th the depression nearly lost its identity over central Europe, owing, probably, to the rapid advance and large extent of area No. VII, which neutralized the effects of the moderate depression there central by an indraught of air from the south and east, which nearly restored the atmospheric equilibrium. During the 18th rain fell at nearly all stations throughout Germany and Austria, with the pressure generally below 29.90. On the 19th occasional rains, with rising pressure prevailed, except at Hermannstadt and Lemberg, where the barometers were respectively 29.76 and 29.73. 20th, probably central north of the Black Sea; Kieff, 29.53, E; Nikolaiev, 29.68, SSW; Lngan, 29.62, ENE. During the 21st, probably central over the Caspian Sea; Nukuss, 29.48, a fall of 0.16 inch in past 24 hours, wind ENE; Tashkend, 29.58, no change since the preceding day, wind NW. 22nd, probably central over Toorkistan; Nukuss, 29.43, NE; Tashkend, 29.55, N; on this day the area of 29.60 extended northeastward from Russia to central Siberia; Barnaul, 29.49, a fall of 0.18 inch in past 24 hours. 23d, depression about stationary, lowest barometer at Tashkend, 29.51; at Barnaul the barometer rose to 29.70, wind NW. 24th, probably central over the eastern portion of the Province of Omsk; Barnaul, 29.45, SE; Tashkend, 29.73, calm. 25th, probably central in the valley of the Yenisei; Barnaul, 29.44, SW.; Yeniseisk, 29.45, SE., rain. 26th, very probably combined with a large area of 29.60, then prevailing north of the 60th parallel and between 20° W. and 90° E. No. XV.—The pressure over the British Isles and to the westward did not recover rapidly from the passage of area No. VII, because of its very slow movement from the 20th, when off the Irish coast, to the 25th, when it disappeared north of Scandinavia. On the 25th the pressure fell over the northern portion of the British Isles, from 0.35 to 0.50 inch, with SE. to SW. winds, and occasional rains, but the lowest pressure remained off the western coast; in 55° N., 15° W., 29.22, WSW. rain. During the 26th and 27th, area probably central near the Hebrides, with NE. to NW. winds, falling barometer, and occasional rains over Scotland; barometer fell gradually from the sudden change on the 25th. 27th, in 53° 40' N. 14° W. 29.05, SW. fair; Monach Lighthouse, 29.09, SE; Ardrossan, 29.10, S; pressure over the British Isles generally below 29.30, with rain at every station but three, where it was reported as cloudy or threatening; over the southern portion the winds were southwesterly, with heavy gales along the Irish coast, and over the English channel. 28th, central north of Scotland; Thorshavn 28.95, NE. rain; Monach Lighthouse, 28.95, S; in 53° N. 14° W. 28.89, WSW.; Galway, 29.02, WSW. violent gale; Sandwick Manse, 29.02, SW; along the Norway coast the pressure ranged from 29.10 to 29.30, with S. and SE. winds and occasional rains; the area of 29.80, extended from Greenland southeastward, to central France, and thence northeastward to northwestern Siberia, thus inclosing the whole of northwestern Europe; the area of rain extended northeastward from western France to Finland with south and south-

west gales ranging from 25 to 60 miles per hour. 29th, central off the western coast of Norway; Brono, 28.86, SW., rain; Tromso, 28.96, SW.; Umea, 28.93, SW.; Hernosand, 29.00, WSW.; Christiania, 29.02, SSW.; the pressure over the British Isles rose from 0.20 to 0.50 inch with winds shifting to west and northwest with occasional light rains and generally cloudy weather; violent westerly gales continued over the English Channel, North Sea and the Baltic: the area of 29.80 covered the whole of northern Europe. During the day the depression passed eastward over northern Scandinavia followed by rapidly rising pressure and north to west winds, being central morning of the 30th over the White Sea; Archangel, barometer 29.01, NNE; over central Russia pressure generally below 29.60 with southeast to southwest winds and occasional rains; Ekaterinburg, 29.49, heavy rain. 31st, central in western Siberia; Ekaterinburg, 29.41, WSW., threatening; the pressure was generally below 29.60 over northern Russia with southwest to northwest winds. Of the storms forming over Russia No. V developed over the region north of the Caspian Sea. On the 6th there was a sudden fall in barometer of from 0.07 to 0.15 inch and the circulation of winds, with the accompanying pressure at surrounding stations, is given, as follows: Ekaterinburg, 29.56, E.; Kasan, 29.43, NW.; Krotkovo, 29.39, N.; Astrakhan, 29.56, N.; Nukuss, 29.52, WNW. During the 7th and 8th depression remained central over the province of Omsk; 7th, Krotkovo, 29.43, N., rain; Kasan, 29.49, N.; Barnaul, 29.38, ENE.; Nukuss, 29.73, WSW.; Tashkend, 29.62, calm. 8th, pressure rose from 0.05 to 0.21 inch at all stations. 9th, a fall of 0.09 inch was reported from Barnaul, atmosphere calm, followed on the 10th by another fall of 0.12 inch, wind SSW., cloudy, and at Yeniseisk, of 0.25 inch, wind S., rain. During the 10th passed northeastward beyond the Yenisei, followed on the 11th by rising barometer and SW. winds, rain still continuing at Yeniseisk. No. VIII.—After the passage of area No. III, the pressure still remained low north of the Black Sea, forming on the 13th a slight depression in the vicinity of Kieff, barometer 29.41, W. From the 14th to the 16th, depression remained about stationary over the region between the Black and Caspian seas, finally disappearing on the 17th by the encroachment of a high pressure from central Europe. Only one area for the month has been charted off the Asiatic coast. No. IX.—On the 12th the isobar of 29.80 generally covered the Japan Islands, accompanied by SE. to SW. winds, and on the 13th a fall of from 0.07 to 0.18 inch was reported, the depression appearing to be central over the Japan Sea. 14th, probably central south of the Island of Yesso; in 41° N., 152° E., 29.36, S., rain; in the vicinity of Yeddo the barometer fell about 0.10 inch, with winds shifting to westerly. 15th, probably central south of Kamtchatka peninsula; in 43° N., 158° E., 29.43, S., threatening; in 39° N., 144° E., 29.63, SW., fair; the winds over the Japan Islands generally shifted to N. and NE., with a slight rise in pressure. 16th, in 45° N., 164° E., 29.48, W., cloudy. 17th, in 46° 30' N., 170° 45' E., 29.42, S.; in 52° N., 175° 40' E., calm, clear. 18th, in 47° 39' N., 178° 21' E., 29.74, S., fair; in 52° N., 175° 40' W., SE., cloudy. 19th, in 48° 11' N., 174° 03' W., 29.87, S., cloudy; in 52° N., 175° 49' W., SW., fair. 20th, depression disappeared in a high area then prevailing to the south of Alaska: in 48° 11' N., 166° 03' W., 30.05, SW., foggy.

TEMPERATURE OF THE AIR.

The mean temperature of the air for July, 1881, is shown by the isothermal lines (in red) on chart No. II. The table of mean and comparative temperatures in the right hand corner of the chart shows, in the first column, the average for the month throughout the various districts, as deduced principally from observations taken at Signal Service stations. In the two remaining columns are shown the means for the present month, and the departures of such means from the average for many years. Throughout the entire country west of the 107th meridian, the mean temperature of the month is from 1°.9 to 4°.3 below the normal. Eastward of this meridian, except in New England, there has been a general increase in every district over the average mean temperature for many years, being most marked over those States lying between the 82° and 90th meridians, where the excess ranges from 1°.7 to 2°.0. It is interesting to note that this elongated region of high mean temperature lies between thermometric normals in the Middle Atlantic States to the east and in the Mississippi valley to the west. The departure from normal over the whole of the Eastern Rocky Mountain slope, shows a gradual transition from the area of deficiency to that of excess.

Ranges of Temperature at Signal Service stations.—Monthly ranges in general varied from 35° to 40° over the country east of the Rocky Mountains, and from 40° to 50° to the westward of that region. The *smallest ranges* were: Port Eads, 18°; Key West and Punta Rassa, 19°; Indianola, 20°; New Orleans, 21°; Galveston, Thatchers Island and San Diego, 22°; Macon and Brownsville, 23°; Cape May and Cedar Keys, 25°. The *largest* were: Dayton, 62°; Fort Keogh, Fort Buford and Rock creek, 61°; Fort Benton, 60°; Fort Assinaboine and Missoula, 59°. The *daily ranges* varied in the different districts as follows: New England, 16° at Thatchers Island to 31° at Burlington; Middle Atlantic states, 16° at Cape May to 31° at New York and 33° at Norfolk; South Atlantic states, 16° at Macon to 28° at Augusta; Eastern Gulf states, 16° at New Orleans and 17° at Key West and Punta Rassa to 32° at Vicksburg; Western Gulf States, 13° at Port Eads and 18° at Indianola to 31° at Denison and Fort Gibson; Rio Grande valley, 29° at Rio